S I R E S Y S T E M

PROGRESS REPORT NO. 1

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SIRE SYSTEM PROGRESS REPORT No. 1

BACKGROUND:

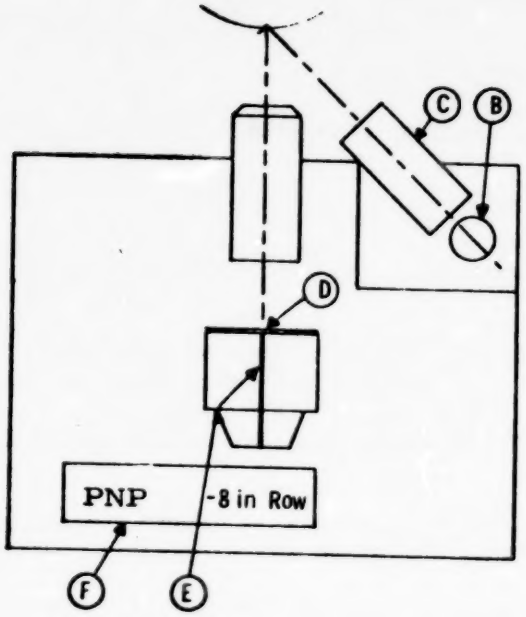
The group of computer systems now known as the Canada Land Data Systems (CLDS) have origins which go back as far as 1962 when the preliminary proposals were made to the Agricultural Rehabilitation and Development Agency to create a computer system to handle the Canada Land Inventory. The system subsequently developped was best known as the Canada Geographic Information System (CGIS) and has had at least four different names in its lifetime, and has operated under five different government ministries since it was officially delivered in 1968. Fifteenth birthday celebrations were recently held. The CGIS was the first significant geographic information system in Canada, one of the first in the world and certainly one of the most successful and long lived.

One of the innovations in the CGIS was the use of a large scale optical drum scanner for data input. The scanner was considered necessary to handle the very high data volumes implied by the continent-wide Canada Land Inventory. The scanner was designed under contract and custom-built by IBM. This device, which carries IBM serial no. 00000001, was delivered in 1966 and has been in daily use since 1968, a tribute to its good design (Fig. 1).

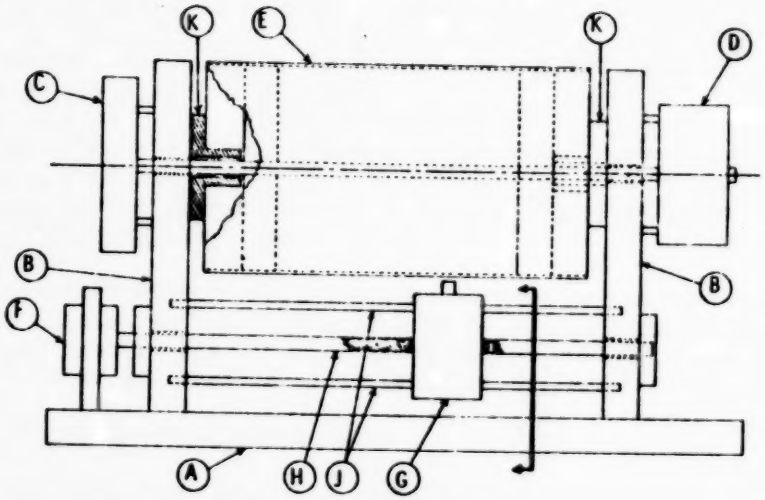
Over the past 15 years the CGIS has undergone considerable change through the introduction of mini and microcomputers, interactive graphics terminals across Canada, high speed plotters, colour graphics screens, etc. Virtually every component of the system has been replaced and upgraded several times with the exception of the drum scanner. The increasing data volumes and increasing threat of catastophic failure of this old device prompted the search for a replacement for this part of the system, and no less important, a means of financing the project.

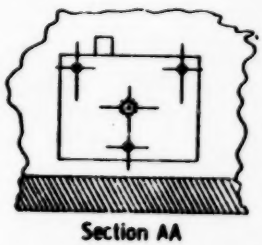
The result of this search is the **SIRE** (Scanning Input and Raster Editing) project which when completed will revolutionize our whole approach to the data entry function at CLDS. Apart from a new optical drum scanner, the new system will allow for the interactive editing of scanned documents, greatly enhancing the flexibility in choice of input document and easing the manual effort in document preparation.

This is the first in a series of progress reports on this important project, which will be distributed to a long list of interested (we hope) agencies and establishments in Canada and internationally.



A - Objective Lens
B - Scan Lamps
C - Scan Lamp Lenses
D - Apertures (8)
E - Fiber Optics
F - Phototransisters (8 In Row)





Section AA

A	Base Plate	F	Leadscrew Drive Motor
B	End Plates	G	Scan Heads
C	Shaft Encoder	H	Lead Screw
D	Drive Motor	J	Scan Head Guide Rods
E	Drum	K	Drum-Support Bearings

FIG. 1 DESIGN SKETCHES FOR THE IBM SCANNER (ca. 1965)

PROJECT OBJECTIVES:

The project goals as abstracted from the developper's original proposal are as follows:

- Overview:

It is proposed to develop an integrated turnkey system for scanning and raster editing, including:

1. a drum scanner for large-size documents, with variable resolution and grey level or colour discrimination capability;

2. a minicomputer subsystem, called the host computer, with hard disk and a tape drive;

3. a raster editing subsystem, based on a version of the XYZ/MACHINE, the graphic microcomputer developed by XYZ GRAPHIC SYSTEMS INC., Montreal;

4. software for local raster editing of the digital picture on the editing substation;

5. additional software functions to improve the efficiency of map production and editing.

The above features will simplify considerably the vectorizing process which will be performed on a large computer.

The general configuration of the system will be modular. Different types of scanning units may be employed.

Systems available outside Canada do not usually have the raster editing features proposed here. This is a key point for the efficiency of a scanner, for it is much easier to handle digitized files in raster format for editing and clean-up.

The cost-performance ratio will be improved by implementing the appropriate raster editing software on a network of specialized microcomputers. This concept, broadly used in microelectronics, will be a new feature in this application. It permits to achieve the following simultaneous goals:

1. reduction in hardware cost;

2. decentralization of the computational effort;

3. improvement of the system response for interactive work.

The most original feature of the proposed raster editing subsystem consists in a systematic use of concurrent programming which allows multi-task data processing on the master CPU and an efficient dispatch of the work load between the specialized processing units. This concept has already been

implemented on the XYZ/MACHINE, developped jointly by our organization and XYZ GRAPHIC SYSTEMS INC., Montreal.

Statement of the Problem and Proposed Solution

The old IBM scanner used by Environment Canada presents several draw-backs:

1. insufficient accuracy, therefore much preparation time is required to engrave the thematic maps prior to scanning;

2. insufficient resolution of 0.004 inches only, which is insufficient to segregate lines too close to each other;

3. final editing is performed on the vectorized maps only, therefore many erroneous nodes must be eliminated by hand.

A direct solution to these problems consists of integrating a high resolution scanner (0.001 inches) and a raster editing console. This will bring the following improvements:

- the optical discrimination capability of the scanner will diminish extensively the engraving preparation time for thematic maps, and will even eliminate it completely for several types of maps;

- the improved resolution of up to 0.001 inches permits the segregation of most of the contours of a topographic map, hence reducing subsequent editing time;

- the raster editing console allows an efficient and interactive clean-up of the raster files prior to raster-to-vector conversion. Hence erroneous nodes are eliminated, lines breaks can be closed,

All these features will increase considerably the productivity of the work conducted by several departments using already the IBM scanner of Environment Canada.

General Architecture of the System

The system will include the following units:

1. the scanner;

2. the interfacing minicomputer, or host computer, with hard disk, tape drives and command console;

3. the editing subsystem with high resolution video display, tape drive, hard disk and floppy disks.

Several remote editing subsystems may be connected to the system.

The minicomputer controls the scanning process and uses its tape medium disks for temporary storage. The data is then compressed, and the work load distributed to the editing subsystems.

The hard disk of each editing subsystem permits a complete and efficient raster editing of the digitized files. This work is performed locally and interactively on each editing subsystem. The floppy disks enable the loading of several types of application programs on the subsystem microprocessors.

Finally, the edited raster files are sent back to the host minicomputer, to be written on a magnetic tape for further batch raster-to-vector conversion.

PROGRESS TO DATE:

1. Contract negotiation and financing:

The project has been approved through the "Unsolicited Proposal" mechanism of the federal Department of Supply and Services. For non-Canadian readers, this is a process by which unique and original development projects proposed by industry can receive bridge funding for start-up costs from a central agency (Supply and Services). This fund serves two purposes -- a) it aids Canadian industry by providing the start-up costs for the development of products designed for a specific project, but which have prospects for more general marketing and application in both the public and private sector and -- b) it assists government departments in obtaining new and innovative products where there is insufficient budget for the one time start-up costs.

The full cost of this development effort is about $700,000 of which about half comes from the unsolicited proposal fund. The remaining costs are being shared on a cooperative basis between several portions of Environment Canada (Lands, Canadian Forestry Service, and National Parks Service) and other federal ministries - Department of Energy Mines and Resources and Agriculture. The contributions from these outside agencies are substantial and are considered vital to the sucess of the project. Their cooperation is greatly appreciated.

After a great deal of complex financial and technical negotiation, a contract with Trochu Calcul Scientifique Inc. (TCS) of Montreal was signed and ratified by all parties in March 2, 1983.

2. Scanner and host-minicomputer selection:

After thorough evaluation of alternatives jointly by TCS and ourselves, the scanning device to be used by the system was selected by the end of March, 1983. The chosen scanner was the X4040 Large Format Scanner/Laser Film Recorder manufactured by Optronics International Limited. The X4040 can scan black and white or color line art and continous tone graphic copy material at several user-selectable resolutions (25 to 1600 microns). The active scanning area is 1m X 1m. The target time to scan the type of thematic map material typical of CLDS work is 15 minutes.

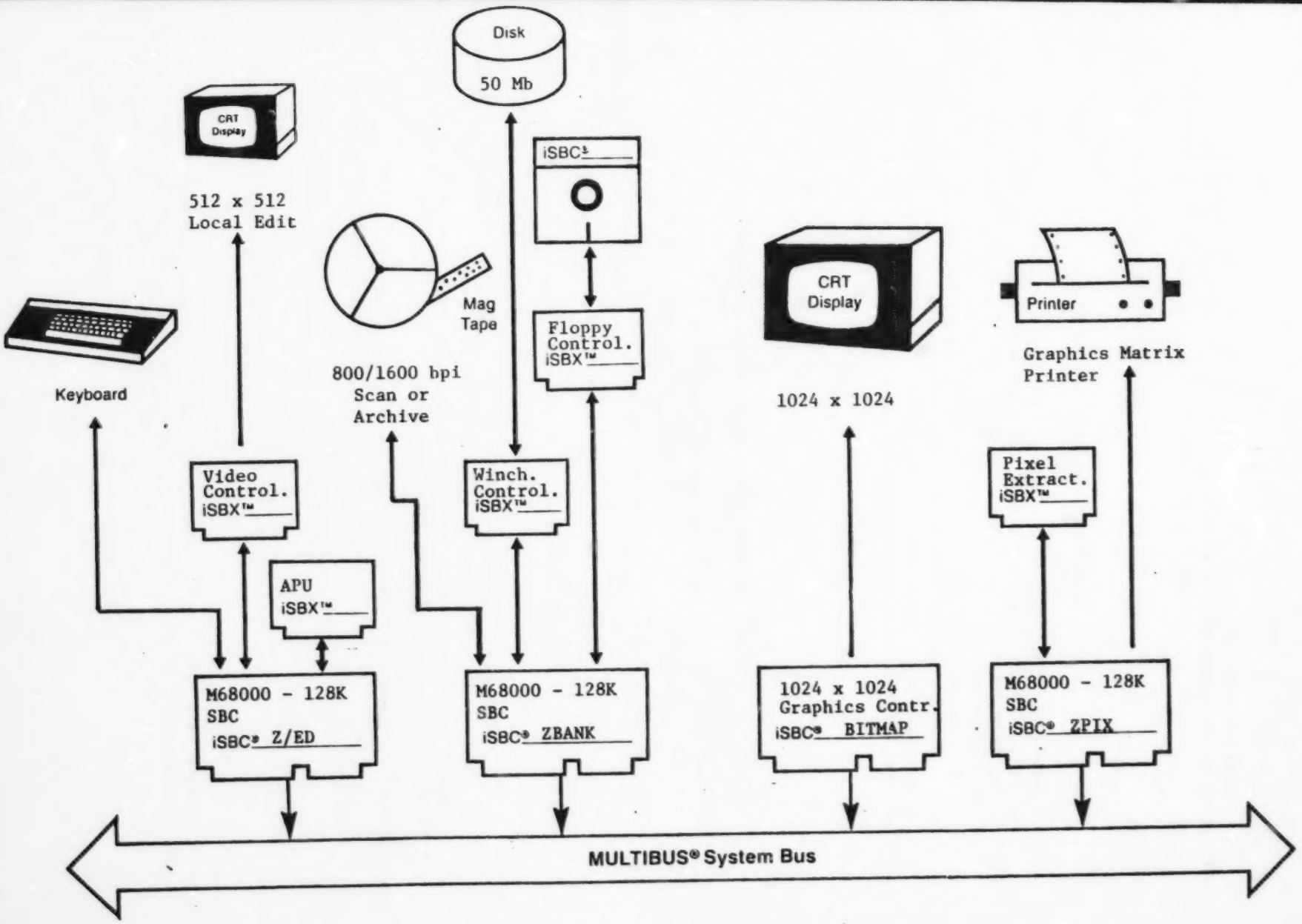


FIG. 2 **XYZ/ed Machine**

The scanner will also be equipped with an argon-ion laser plotter capability with similar resolution for preparing output negatives on film. The scanner/plotter is controlled by a Z80A microprocessor.

The host mini-computer is to be a PDP-11/24.

3. Conceptual Design of Raster Editing Substation:

In late June, the conceptual design for the raster editing substation was presented by TCS and approved by CLDS. One significnt deviation from the initial concept is that a tape drive was deemed necessary for high volume data transfer, in addition to the planned direct communication link with the host mini. The editing substation is to be based on the "XYZ" machine, a multiprocessor microcomputer developped by another Montreal company. This version is to be called the "XYZ/ed" machine and a conceptual diagram is included in this report (Fig. 2). Many changes are likely before the final tested model is delivered.

NEXT STAGES:

The project is divided into four distinct phases as follows:

A. Detailed design of system configuration, analysis and development of software procedures.

B. Implementation of the particular software on the editing subsystem.

C. Integration of System Components.

D. Additional Software functions specifically adapted to the production environment.

Phase A is now nearly complete. It is expected that the scanner will be delivered to our premises in Place Vincent Massey by September, 1983 and (hopefully) we will have the site preparation complete by then. After a test period we expect the scanner to be available on a stand-alone basis by November.

The target date for the completion of the entire project is May 2, 1984 although some slippage seems likely.

The production operation target is for July 1984.

FURTHER INFORMATION:

For any forther information on the details of this project, the technical authority is Mr. Michel Comeau, Canada Lands Data Systems, Lands Directorate, Environment Canada, Ottawa, K1A 0E7.

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